

2 AWIPS SITE COMPONENT CONFIGURATIONS

The AWIPS is an information gathering, processing, and communication package designed to merge all components of the modernized NWS into a highly integrated and efficient weather forecast and warning system. The implementation of AWIPS is the final step in arriving at full operational capability of the modernized NWS network. There are three main components to AWIPS:

1. Operational site hardware configurations, including interfaces to other office systems.
2. Software produced by a variety of government entities and the AWIPS prime contractor.
3. ACN interconnecting NWS sites with the Network Control Facility (NCF).

The NWS plans to commission AWIPS as the primary communication and processing system at all field offices starting near the beginning of CY 2000 with the advent of software Build 4.2. This section of the *Plan* provides descriptions of the major components of AWIPS.

2.1 Major System Configurations

This section provides descriptions of the AWIPS equipment and configurations for the various office types, NWSFOs, NWSOs, RFCs, and NCEPs.

2.1.1 General NWSFO and NWSO Configuration

The AWIPS NWSFO and NWSO configuration consists of, on average, five workstations (WS), two application servers (AS), two data servers (DS), four communication processors (CP), and various routers (see Figure 2-1). There are two AS and DS site components because one is considered a primary system and the second often is a “mirrored” redundant one. A complete list of office-specific equipment (i.e., the site components) is in Appendix A.

The DSs retrieve and store weather data and official NWS products. The CPs provide the interface to receive data and products and send them to the DSs. The ASs serve as the interface for an asynchronous (ASYNC) AFOS emulation and run various applications. The WSs serve as the “man/machine” interface to all AWIPS functions and can simultaneously display all weather information. Each WS is equipped with three displays capable of handling both graphical and textual products. One WS can display any combination of complex numerical models and image data in five windows on its two graphical displays, while the third can be used to produce forecast or warnings.

Each NWSFO and NWSO is equipped with an SBN downlink receiving two of the four broadcast channels. One channel receives the satellite imagery data, while the second channel carries NCEP-generated guidance and model products and observations. All observational data derived or collected by the site, and locally generated products are transmitted to the NCF over terrestrial circuits for further processing and/or retransmission to the NWS Telecommunication Gateway (NWSTG) or over the SBN to all AWIPS sites.

Each office (except NCEPs) receives the LDAD suite of hardware (see Figure 2-2) to perform the data acquisition and dissemination function. A complete description of the LDAD functionality planned for field use is found in Section 2.3.1. For a more complete description of both continental United States (CONUS) and outside CONUS (OCONUS) configurations for AWIPS with links to other office systems, refer to Appendix C.

2.1.2 General RFC Configuration

The role of an RFC is to provide hydrologic forecasts and guidance products for NWSFOs, NWSOs, and external users. These products include river and stream forecasts for routine, high water, and flood situations, flash-flood guidance for short-fused watch/warning purposes, and long-term seasonal river and water-level forecasts. In the modernized network, each RFC site is collocated with a NWSFO or NWSO site to form a more efficient combined NWSFO/RFC or NWSO/RFC complex. Each of the 13 RFCs is responsible for a geographical area covering one or more river basins.

Each RFC is equipped with its own AWIPS, similar to the NWSFO configuration, including an LDAD suitable for handling associated hydrologic data and an “RFC Gateway” capability (see Figure 2-3) for exchanging information with the hydrologic community. Various communication links are provided to permit the receipt of gauge data, centrally processed guidance data, and related products used in developing the hydrologic guidance products.

Each collocated office also serves as a terrestrial network “hub” for NWSFO, NWSO, and NCEP “node” sites. Routers at the collocated sites forward official NWS products from these “node” sites to the NCF for further distribution. Refer to Section 2.4.1 for a description of NCF operations and Appendix A for graphical depictions of these network configurations between hub and node sites. In addition, RFCs will continue to issue products through AFOS to locations it supports until those offices have all commissioned their AWIPS.

The RFC in Alaska has a different configuration than the conterminous regions since this region does not have AFOS (see Appendix C). It has a connection to the Alaska Region Operations Network (ARONET), which is the equivalent of AFOS in the Alaska region. Refer to Appendix C for a more complete description of how AWIPS is configured with other systems within the office environment in the Alaska Region.

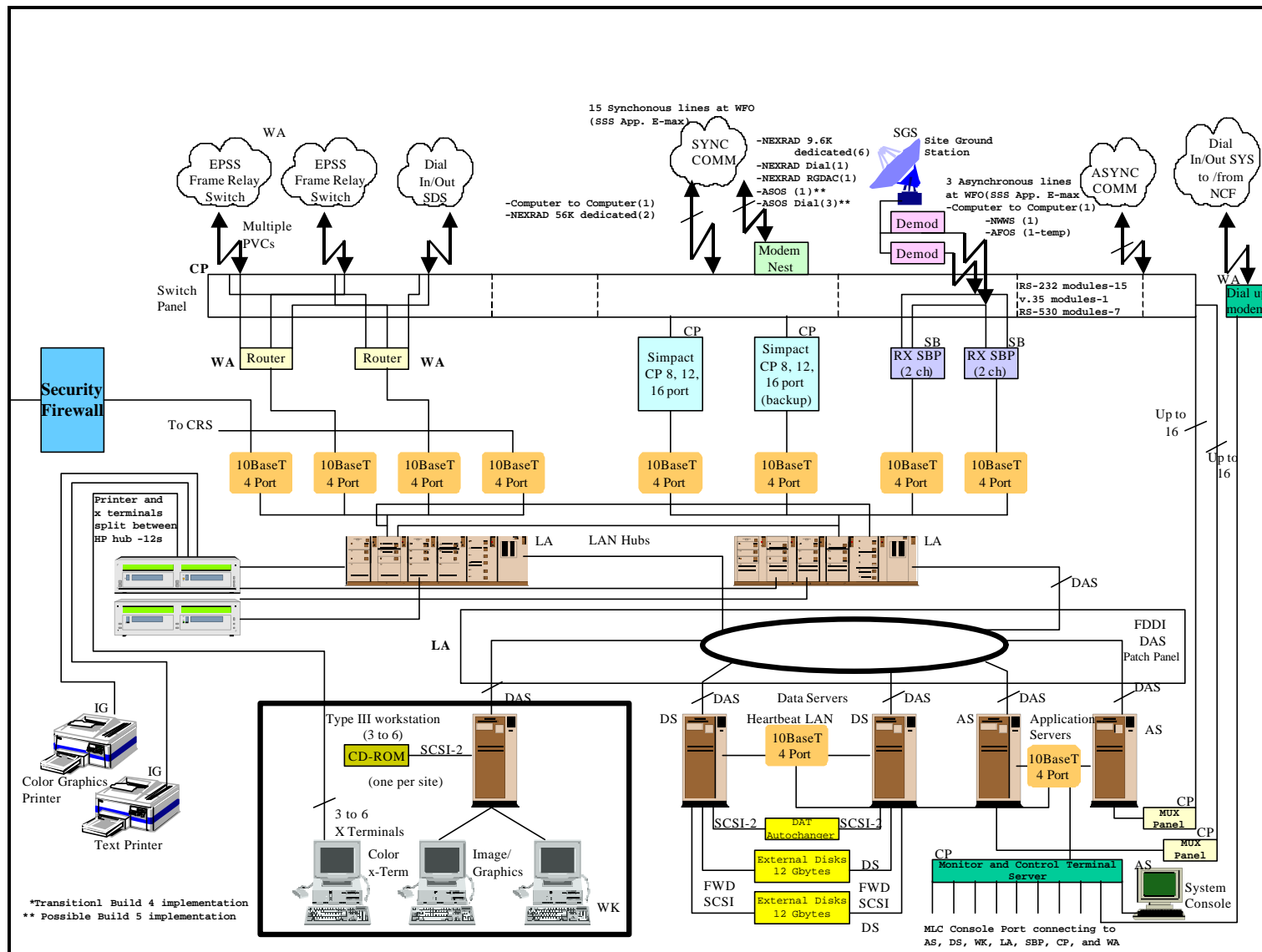


Figure 2-1 AWIPS Site Components

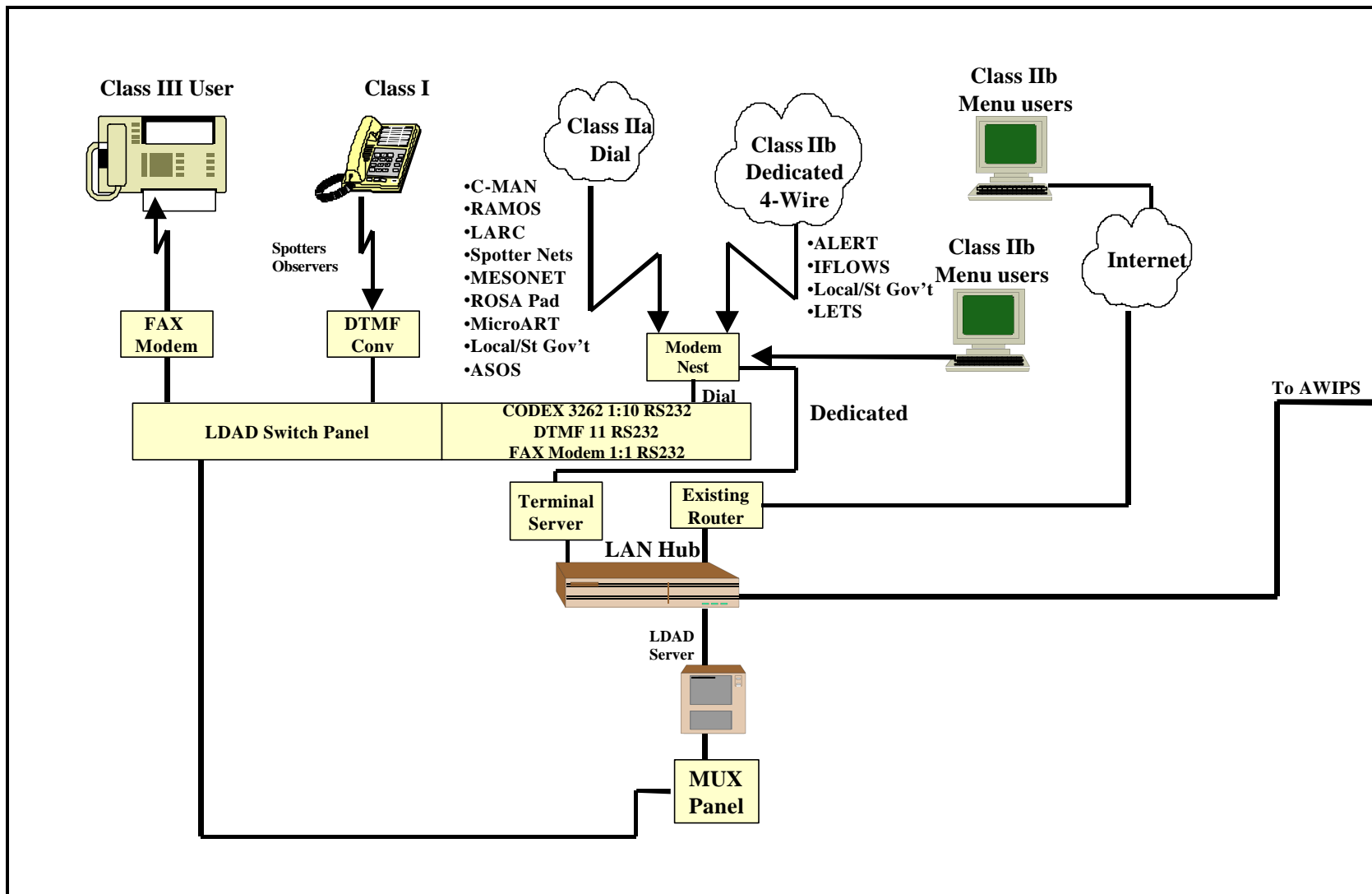


Figure 2-2 LDAD Site Components

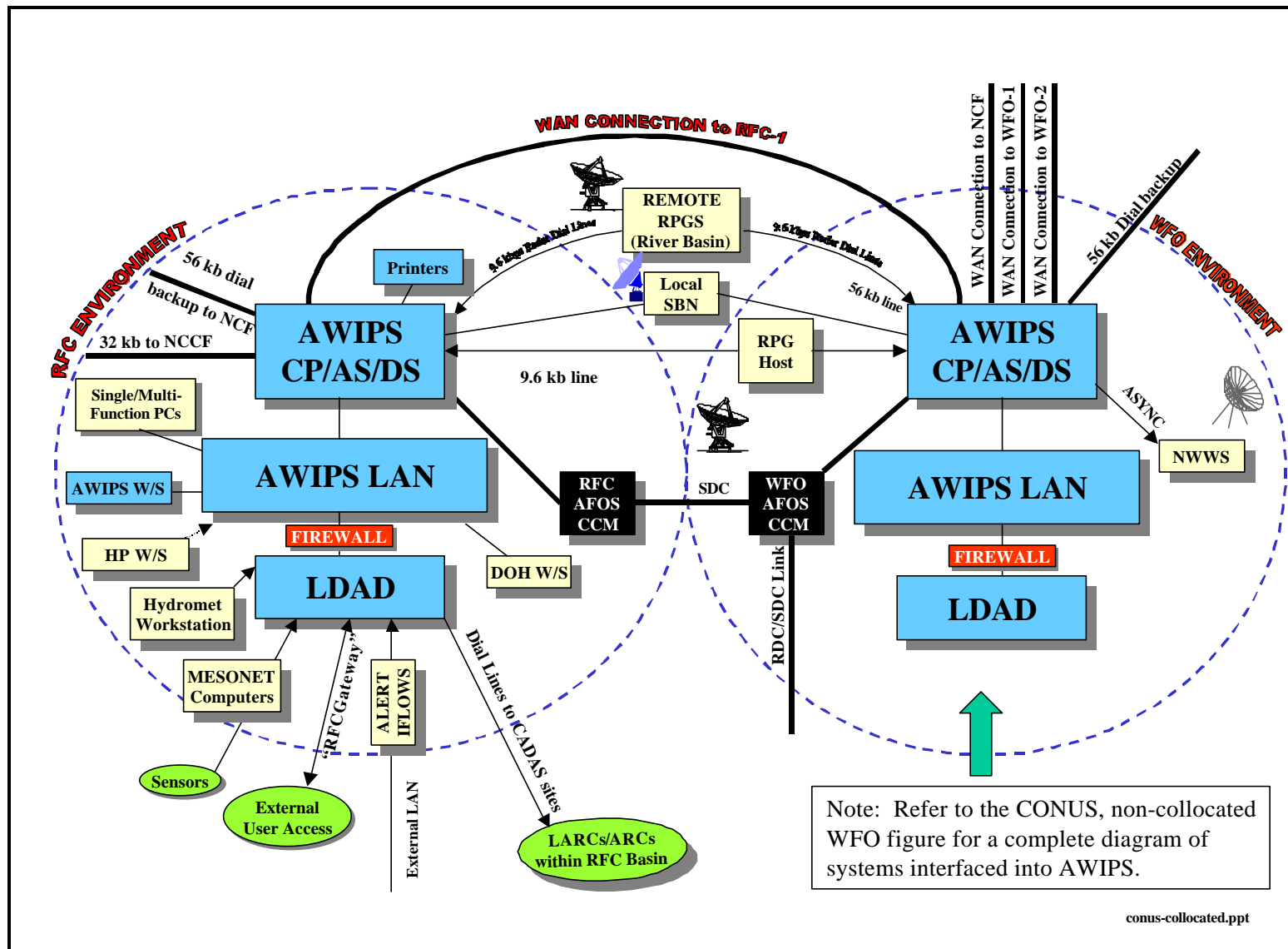


Figure 2-3 CONUS Collocated NWSFO and NWSO/RFCs

2.1.3 General NCEP Configuration

Each NCEP has responsibility for providing national and international, forecast and warning products, a wide range of model-based global atmospheric and oceanic model analyses, and guidance products to NWS field offices as well as the general meteorological community.

The current AWIPS National Centers (NC) are:

- ! Camp Springs, MD—location of the Hydrometeorological Prediction Center (HPC), Marine Prediction Center (MPC), Climate Prediction Center (CPC), Environmental Modeling Center (EMC), and NCEP Central Operations (NCO)
- ! Kansas City, MO—location of the Aviation Weather Center (AWC)
- ! Miami, FL—location of the Tropical Prediction Center (TPC)
- ! Norman, OK—location of the Storm Prediction Center (SPC)

There is a fifth NCEP site for which there are no current AWIPS requirements. This is the Space Environment Center (SEC) in Boulder, CO. The functions and strategies regarding AWIPS at the NCs have not changed as a result of the reorganization into the NCEP.

The NCEP component responsible for providing the computer services critical to performing these functions is the NCO. It manages the implementation, modification, and monitoring of all operational software, hardware, communication, and security systems to ensure the reliability of critically scheduled services. The equipment and software specific to each NC site are operated and maintained by the site with support from the NCO.

The greatest quantity of NCEP guidance is the direct output of the various Numerical Weather Prediction (NWP) models that run within the NOAA Central Computer Facility (NCCF) in Suitland, MD. As these computer-generated products are created, they are made available to users via the NWSTG. In addition, each NC makes some products available to NWS field forecasters through the AFOS system. As AWIPS is commissioned at NCEPs, product distribution will be provided via AWIPS. Computer-generated guidance is delivered from the NCEP to the field offices via the NWSTG, while guidance products will be created within AWIPS and delivered to field offices.

Each NC has other system capabilities that continue to be required after AWIPS is deployed. This implies that some non-AWIPS equipment must become an integral part of the AWIPS local area network (LAN) at each NC. In addition, some equipment outside of AWIPS will function very much like the AWIPS equipment itself—relying upon the AWIPS data base and application software. Accordingly, some equipment located outside the AWIPS LAN at each NC will need access to the local AWIPS (see Figure 2-4).

When AWIPS is commissioned, NCEP model guidance will follow a communication path to the local forecaster that is similar to the path used today. The NCO passes data to the NWSTG where it is sent to the AWIPS NCF for transmission over the SBN to users. Official NWS products created at the NWSFOs, NWSOs, and RFCs are transmitted via the AWIPS WAN to the NCF, where they are transmitted over the SBN and redirected to the NWSTG (refer to Appendix A).

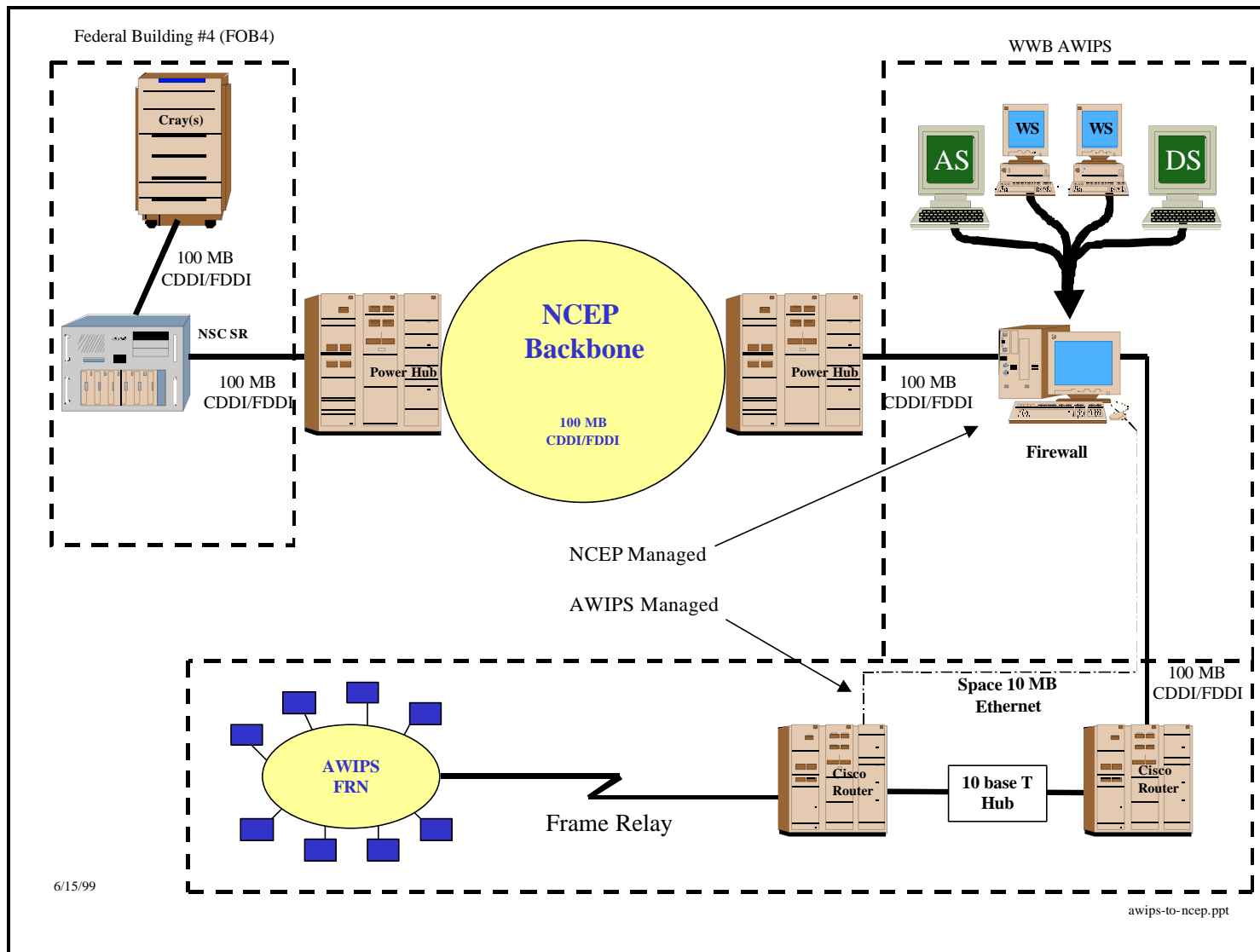


Figure 2-4 Proposed AWIPS-to-NCEP Connectivity Plan

2.2 Software Builds

AWIPS software “builds” serve to integrate large areas of functionality under each significant software load. Build 4 has been identified as the software series having sufficient capability to support AWIPS commissioning. Under each build, there are several incremental loads, called “point releases,” allowing corrections to significant deficiencies found during test and evaluation exercises or to complete portions of functionality that, for some reason, were not included in the initial release. **Build 4.2** is scheduled to meet these objectives and is the earliest version NWS sites can use to commission AWIPS.

The software consists of a conglomerate of application programs and “scripts” developed by the Forecast Systems Laboratory, Techniques Development Laboratory, Office of Hydrology, and the prime AWIPS contractor. AWIPS software is based on the Hewlett Packard UNIX operating system and the INFORMIX® data base.

Each office with an associated radar (see Section 2.3.2) will have Release 10 software for the Weather Service Radar-88Doepler (WSR-88D) installed before Build 4.2 is fielded. One feature critical for AWIPS in this release is the upgrading of the dial lines on the WSR-88Ds from 9.6-kbps to 14.4-kbps.

The Office of Hydrology has developed several hydrologic-specific software applications to be delivered with the Build 4.2 software. This includes the WFO Hydrologic Forecast System (WHFS) including RiverPro, and the NWS River Forecast System (NWSRFS), packages supporting NWSFO, NWSO, and RFC operations. These packages also utilize the INFORMIX data base, referred to as Hydrobase, which is separate from the data base used for the primary data display functions in AWIPS. Hydrobase is used for hydro applications at both WFOs and RFCs.

Also, NCEP is working with Build 4.2 to develop a version meeting their center-specific needs. The NCs will require a number of capabilities beyond those needed by other field offices. The forecast processes at the national level require:

- ! image, observational, and model data spanning extended spatial and temporal scales;
- ! output from both operational and experimental numerical weather prediction models at the full resolution, temporal, and geographic extent of the model; and
- ! tools to produce “manually enhanced” graphic products and, eventually, grids to support AWIPS and other users.

The NCEP continues to be responsible for the development of the unique capabilities required by the NCs for integrating those capabilities into the national AWIPS. The AWIPS software capabilities unique to the NCs, and necessary to support the NWS’s end-to-end forecast process, are being developed by the Computing Development Branch within the NCO. The plan is to implement Build 4.3 at Ncs before beginning the AWIPS commissioning process. This load provides the necessary scales for meeting the NC’s coverage requirements.

2.3 System Interfaces

One of the key features of AWIPS is the interfacing with other systems in the office environment. AWIPS will become the office interfaces to systems connected to the site. In this way, AWIPS becomes the “nerve-center” for office operations. These include, but are not limited to, the following:

- ! All associated radars (WSR-88D), including Department of Defense (DOD)/Federal Aviation Administration (FAA) systems
- ! All associated Automated Surface Observing Systems (ASOS)
- ! NOAA Weather Wire Service (NWWS), including both existing and the replacement system
- ! Microcomputer-based Automated Radio Theodolite (MicroART)
- ! Console Replacement System (CRS)
- ! Automated Local Evaluation in Real Time (ALERT) and Integrated Flood Observing and Warning Systems (IFLOWS)
- ! Coastal-Marine Automated Network (C-MAN), Automated Hydrological Observing System (AHOS), Automated Remote Collector (ARC), and Limited Automated Remote Collector (LARC) associated with the Centralized Automated Data Acquisition System (CADAS)
- ! Spotter networks and Mesoscale Observation Networks (MESONET)
- ! Remote Observation System Automation (ROSA) data entry pad function
- ! High-Resolution Picture Transmission (HRPT) Image Processing System (HIPS)
- ! Local and state government computer systems, and state Law Enforcement Telecommunication Systems (LETS)

Some of these systems (such as the NWWS) are interfaced directly into the AS. These systems are situated inside the “firewall,” since they are deemed NWS-secured systems. Systems not considered “protected” must first pass through a firewall system before entering inside the AWIPS. For many of the systems described above, the LDAD is the principal mode for interfacing into AWIPS. Other systems (such as the CRS) are configured through the AWIPS LAN. Systems can also be interfaced into AWIPS through asynchronous ports. Any specialized local application residing on a personal computer would be interfaced in this way. Refer to **Table 2-1** to determine how each office system will be configured within AWIPS and at what point the interface transfer can occur. Appendix C provides additional information on system interface configurations for different office types.

Table 2-1 Systems Interfaced to AWIPS Transition

System to Be Interfaced	AWIPS Interface	Products to Be Distributed	Type of Interface	Point When Inter-face Transfers
NEXRAD Primary Secondary Supplemental Service Backup Auxiliary	Synchronous Ports	RCM, 2 Hydro products (DPA and HDP) to WAN	Dedicated Dial Dial (Ded) Dial Dial	AWIPS Acceptance
ASOS ASOS Other Than ASOS (OTA) RAMOS (300 baud)	LDAD	METAR SPECI (special) DSM/MSM SHEF (the above through WAN)	Dedicated (<4Kft) or Dial	Beginning of Commissioning Evaluation (Build 4.2)
Upper-Air MicroART	LDAD	Synoptic messages via WAN	Dedicated or Dial	Beginning of Commissioning Evaluation (Build 4.2)
Hydro Systems ARCs/ LARCs (CADAS) IFLOWS ALERT	LDAD LDAD LDAD	ARC/LARC SHEF-encoded	Dial	AWIPS Acceptance and Build 4.1
MESONET (Spotter Network) Meso-1 Meso-2	LDAD LDAD		Dedicated or Dial	AWIPS Acceptance and Build 4.1
CRS	LAN	CRS Suite to External Users	LAN	Beyond Build 4.2
NWWS (Existing)	ASYN	NWWS Suite to External Users (PIL)	Async	AWIPS Acceptance and Build 4.2
NWWS (Replacement)	LAN	NWWS Suite to External Users (WMO)	LAN	During FY00
ROSA DTMF	LDAD (replaces ROSA)	SHEF	Dial	AWIPS Acceptance and Build 4.2 or beyond
HIPS	LAN	Selected Satellite		Beyond Build 4.2
Marine Systems C-MAN	LDAD	Marine related	Dial	Beyond Build 4.2

2.3.1 Local Data Acquisition and Dissemination

LDAD, an integral part of AWIPS, enables users to interface with local data sources and receive weather data and products. NWSFOs, NWSOs, and RFCs are receiving LDAD systems in order to interface to a number of data collection systems currently connected to office hosts (e.g., AFOS). LDAD also performs a dissemination function to local users.

2.3.1.1 LDAD Classes

There are three classes of LDAD users:

1. Class 1 users operate a dual-tone multifrequency (DTMF)-to-American Standard Code for Information Interchange (ASCII) converter to receive weather reports via telephone from cooperative observers and spotters. Class 1 interface is for data acquisition only.
2. Class 2 users operate computer-to-computer interfaces to collect data from sensors and platforms, and to disseminate weather products to the user community. These users are divided into sub-classes: Class 2A, which is a direct file transfer user; and Class 2B, which is an interactive menu user. Class 2 interfaces support both data acquisition and dissemination.
3. Class 3 users operate a facsimile interface, over dial-out phone lines, allowing AWIPS to disseminate weather data to specific segments of the external user community.

The goal and objective of the LDAD function is to provide interfaces for AWIPS sites to interface with local data sources and local data users for the acquisition and dissemination of weather data and products.

For the Class 1 interface, AWIPS receives the DTMF via a two-wire dial-in connection representing the ROSA formatted data. ROSA data are converted to ASCII format, then presented to AWIPS through an LDAD dial-in/dial-out asynchronous port.

For the Class 2A interface, AWIPS uses a computer interface to receive/transmit weather data from/to remote sensors and external users utilizing a file transfer format. External users access AWIPS to select and retrieve weather data such as watches, warnings, advisories, and special statement products. Dedicated and dial-in/dial-out LDAD ports are used to service Class 2A users. Class 2A interfaces include ALERT, IFLOWS, C-MAN, Automated Meteorological Observing System (AMOS), Remote AMOS (RAMOS), AHOS, LARC, Next Generation Water Level Measurement System (NGWLMS), spotter networks, MESONET, ROSA, data entry pad, local and state government computer systems, state LETS, and MicroART systems.

For the Class 2B interface, six menus enable external users to select and retrieve weather data such as watches, warnings, advisories, and special statement products. Each menu contains a maximum of 20 products. After a product selection is made, it is transmitted to the Class 2B users in Class 2A file transfer format. Class 2B users have the capability to switch between Class 2B and Class 2A modes of operation. Dedicated and dial-in/dial-out LDAD ports are used to service Class 2B users.

For the Class 3 interface, AWIPS sends facsimile weather data to the external user community via a two-wire dial-out connection. Figure 2-5 shows how systems and external users interface into LDAD when the full capability is available, sometime after Build 4.2.

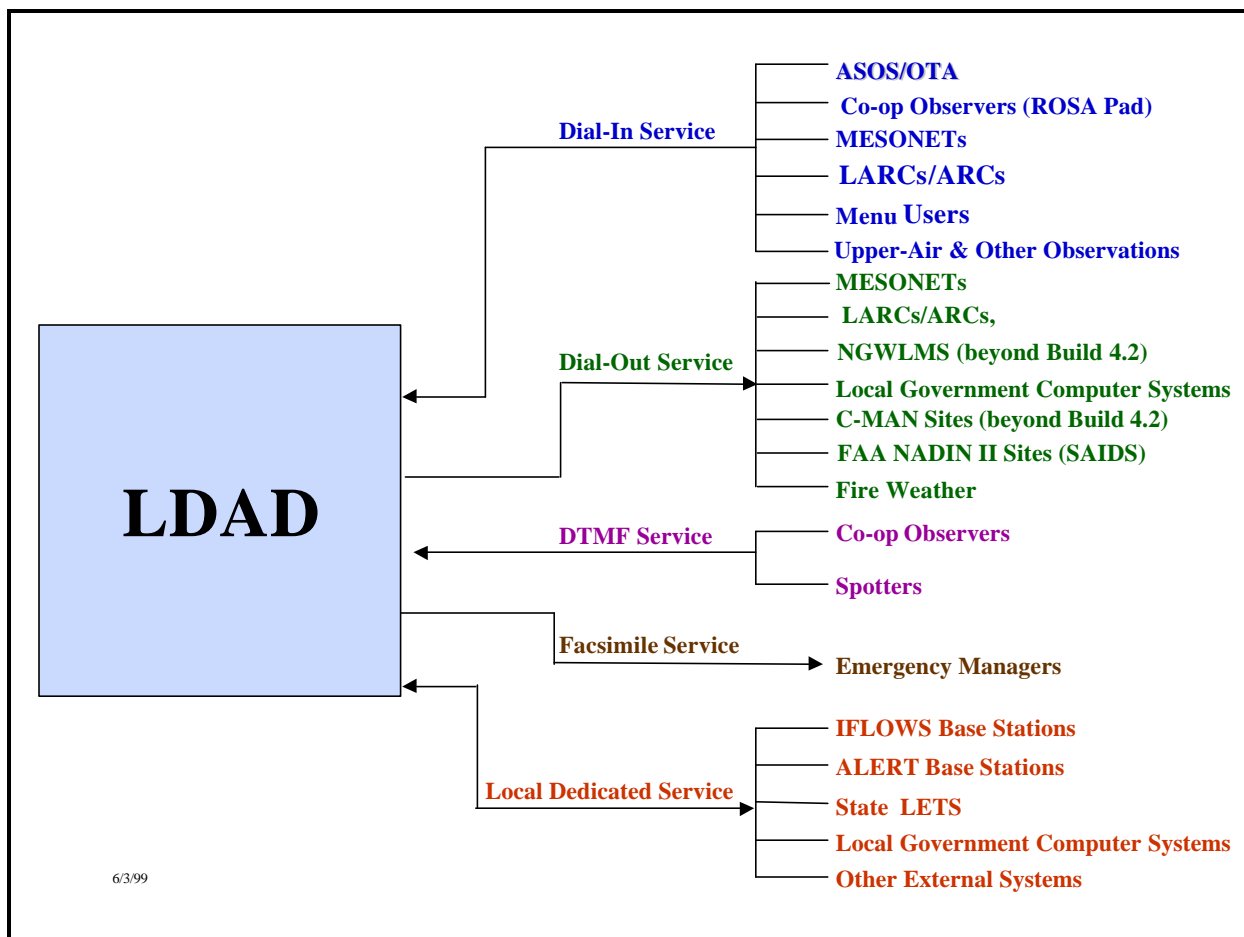


Figure 2-5 AWIPS Local Data Acquisition & Dissemination (LDAD) Interfaces

2.3.1.2 Data Acquisition Function

The AWIPS LDAD system acquires local weather data from emergency operations centers, emergency response networks such as the IFLOWS and ALERT, MESONET, LETS, severe weather spotter networks, cooperative observers, etc., as described in the *LDAD User Language Requirements Document* (August 1994).

The LDAD system has computer-to-computer links for local data acquisition. Agencies can use this portion of AWIPS to download data using the external interface described in Section 2.3.1.3. Agencies can also dial-in and download data directly to AWIPS through the LDAD. For security purposes, the LDAD system contains a “firewall” component to allow only “authorized” users to download data (see Table 2-2).

The AWIPS LDAD system will enhance the collection of local high-resolution hydrometeorological data at the field offices and free local staff from performing manual acquisition of local observations. The main feature of LDAD is its ability to replace systems connected to AFOS that perform these functions. The following systems require interfacing to the LDAD as part of the commissioning process:

NWS-sponsored ASOSs

See Section 2.3.4 for information about initial connectivity of ASOSs collocated with NWSFO and NWSOs under its County Warning and Forecast Area (CWFA).

FAA and DOD-sponsored ASOSs

Initially, DOD and FAA ASOS hourly and specials are supplied to the AWIPS ACN from the NWSTG, probably as “collectives” (collectives are a group of official products). DOD and FAA ASOS five-minute and precipitation data may be collected using the LDAD function of AWIPS at some later time in the development.

MicroART

The present NWS upper-air system consists of a balloon launch shelter used to fill and launch the balloon, a balloon-borne solid-state instrument package (radiosonde) used to observe specific atmospheric parameters and transmit the data back to the ground tracking equipment (radio theodolite), and an IBM PC/XT microcomputer-based system (MicroART) to track the balloon flight data and process the associated weather data. The LDAD at NWSFOs and NWSOs is required to receive upper-air observations from a dial-in or dedicated port. While plans are under way to replace the current upper-air system (MicroART) with a state-of-the-art, upper-air observation system during the lifetime of AWIPS, the current system will still be in use when AWIPS is commissioned. Upper-air observations currently transmitted through the FAA circuits in the Alaska and Pacific Regions will continue in this manner, instead of using LDAD.

Systems Polled by CADAS

The LDAD function of AWIPS has the capability to collect the RAMOS/telephone(T) and LARC observations at offices using AWIPS dial-in/dial-out communication interfaces, provided the rate for transmission is at least 300 baud. The current plan is not to collect observations from AMOS/RAMOS sites using rates less than 300 baud. These sites will either be upgraded to the higher rate or interfaced to some other system. With the commissioning of ASOSs, there do not appear to be any RAMOS/AMOS locations within the CONUS requiring an interface into AWIPS. There may be some residual OCONUS sites still requiring such an interface. This could eliminate the need to collect AMOS/T, RAMOS/T, LARC, and ARC observations by CADAS.

ROSA

Two ROSA formats are provided in the AWIPS Build 4.2 baseline. All cooperative observers will be able to supply their observations to AWIPS, electronically, using push-button telephones or ASCII ROSA data-entry pads. AWIPS utilize dial-in communication lines to interface with cooperative observers. The integration of ROSA into AWIPS eliminates the need for separate computer systems to collect observations from cooperative observers.

Table 2-2 LDAD System

LDAD Service Class	LDAD Service	Number of Ports		Notes
		Large NWSFO and NWSO	Normal NWSFO and NWSO	
Dial-out	Dissemination of warnings	Use ports allocated to menu users		
	Interrogation and acquisition of MESONET LARC and other platform data	Use ports allocated to menu users		4 ports for NWSFOs and NWSOs with >1 FAA ASOS or with 1 FAA ASOS >14 combined LARC, NGWLMS, and C-MAN (67 NWSFOs and NWSOs) 3 ports for other NWSFOs and NWSOs (49 NWSFOs and NWSOs)
Dial-in	Menu users, MESONET, ROSA PAD, etc.	8	4	
DTMF	Co-op observers and spotters data entry	4	3 (A few get 2 or 4)	4 ports for sites with 126-212 co-ops (26 NWSFOs and NWSOs) 3 ports for sites with 51-125 co-ops (73 NWSFOs and NWSOs) 2 ports for sites with <51 co-ops (17NWSFOs and NWSOs)
FAX	Dissemination of products by FAX	1	1	
Dedicated: at Initial Deployment Baseline (IDB)	Local government agencies, emergency managers, etc.	8	4	
Dedicated: future expansion after IDB	Computer-to-computer interfaces to local information services	additional 8	additional 4	
Total Ports	Dial	8	4	At RFCs and NCs, total number of ports is: Dial 8 Dedicated 16 Total 24
	DTMF and FAX	5	4	
	Dedicated	16	8	
	Total	29	16	

MESONETs

Local MESONETs are networks of meteorological and hydrologic sensors supplying data to AWIPS through the LDAD. In many cases, these MESONETs are polled by a computer within the office environment and the data are passed to the host legacy system. Examples of these MESONETs include Remote Automated Weather Station (RAWS), State of Oklahoma MESONETs, etc. In return for these data, MESONET custodians can be supplied with the capability to access information in AWIPS through the LDAD. With the introduction of Build 4.1 AWIPS software, access to MESONET data via LDAD is possible.

IFLOWS/ALERT

The LDAD function of AWIPS will connect with the local IFLOWS base station, which is a PC in the office. Reports are available every fifteen minutes by the IFLOWS base station. In effect, IFLOWS and ALERT are special cases of a MESONET.

The LDAD function of AWIPS provides a connection with the local ALERT base station. ALERT reports are event-reporting and also every hour by the ALERT base station, which consists of precipitation gauges and river level shaft-encoders. Other meteorological sensors, such as temperature and humidity, may exist. In effect, ALERT systems are a special case of MESONET. ALERT data consist of 40-bit message transmitted at 300 baud. ALERT gauges transmit their data to the base station decoder connected to a Hydromet computer or some other device. As with other MESONET connections, this capability is available with Build 4.1 for IFLOWS and ALERT networks.

Spotter Networks

The LDAD function of AWIPS will provide some capability to interface with individual spotters via dial-in communication lines. The individual spotters supply their observations to AWIPS using push-button telephones over dial-in lines. The spotter format is developed by the data provider. AWIPS will also interface with spotter networks using a packet radio centralized collection computer. The centralized computer will transmit spotter data to the NWSFO or NWSO. Spotter networks are able to access information in AWIPS. For the purposes of commissioning AWIPS, only those spotter networks interfaced to AFOS are of interest.

2.3.1.3 Dissemination Function

The NWS provides data to a large number of emergency management and preparedness organizations, consisting of federal, state, and local organizations. Data may be transmitted by manual or automatic methods. Many of these organizations receive forecast and warning data via user-furnished telephone connections or data channels installed in the local NWS office. Data are also exchanged with other agency systems via the NWSTG.

The AWIPS LDAD system will disseminate AWIPS weather data to multiple state and local government agencies including emergency management agencies and the public. The dissemination techniques include:

- ! Direct connections for emergency management users;

- ! Internet for the public (this feature may be provided independently of LDAD);
- ! Facsimile.

The following entities are expected to be primary users of the dissemination portion of LDAD:

Government Agencies

A number of federal government agencies require direct access to NWS data sets and products for their own mission-related activities. For example, the FAA has direct connection to many NWS offices for receiving a host of weather products. This link is referred to as the Systems Atlanta Interactive Devise System (SAIDS) and is used for routing NWS products to various airport-related units. The Army Core of Engineers, Bureau of Reclamation, and Department of Agriculture are other examples of government agencies needing similar connectivity.

Local/State Governments

Local government agencies, utilities, emergency management computer systems, fire weather systems, and other local external systems have direct connectivity to AFOS, ARONET, and Pacific Region Operations Network (PRONET). The LDAD function of AWIPS will provide hydrometeorological data to these local external agencies and users. These users are supplied with the capability to access information in AWIPS. Many of these external systems will also provide data to AWIPS.

LETS - Any NWSFO and NWSO may link with one or more state LETS. This could be done through the LDAD function of AWIPS or through an asynchronous port into AWIPS.

NWWS G20 Users - A select number of NWSFOs and NWSOs have agreements to provide the suite of NWWS products over a direct link to G20 users. This link is also used to recover data/products from external users. This will be attained through the LDAD/firewall, since this connection needs to be secured.

Emergency Managers

The LDAD can be used to distribute AWIPS-generated gridded weather information to external users by the Emergency Management Server (EMS), who are treated as "expert users." The emergency manager community at all levels is considered one of the most important user groups to interface with the LDAD. The ability to provide critical weather information to these groups in a rapid and efficient manner is a cornerstone of this technology.

Broadcast Media

The broadcast media can acquire local AWIPS-generated gridded data with a dedicated connection to the LDAD server, providing access to a specific "media" directory on the EMS. Each media user can download AWIPS-derived weather information in order to process and display images and graphics suitable for public broadcast. The NWSFO or NWSO systems administrator can manage media directories easily using various tools.

2.3.2 Radar (WSR-88D) Interface

The WSR-88D system consists of three major components and a User Control Position (UCP):

- ! Radar Data Acquisition (RDA) unit,
- ! Radar Product Generator (RPG), and
- ! Principal User Processor (PUP), either associated or non-associated with the RDA/RPG.

An RDA unit consists of an antenna, pedestal, tower, and radome; the transmitter and receiver; a timing and control computer; and a signal processor. Functions of the RDA include a radar calibration, suppression of ground clutter, data monitoring and error detection, and base data archiving (level II).

The RPG serves as the primary data processor for the WSR-88D and generates the various output products from base data received from the RDA. The finished products are stored in the RPG and distributed to users through various interface ports. It also performs a number of display, status monitoring, error detection, and archiving functions. The archive level III function, performed at the RPG, is the national product archive for NEXRAD.

PUP workstations are used to provide user access to the products generated and stored in the RPG. Currently, the PUPs are installed at user locations and connected to the RPG ports over dedicated or dial-up phone lines. The PUPs are classified as associated or non-associated. "Associated" PUPs are permanently tied to a designated RPG via a 14.4-kbps dedicated line. A "non-associated" PUP has no permanent link to any specific RPG and utilizes dial-up ports for data transmission. Since PUPs utilize 14.4-kbps communication links, the capacity is not sufficient to allow the full suite of available radar products to be downloaded to the PUP. Each PUP site must, therefore, select and schedule those products required at the site.

Each NWS-owned RPG has an associated PUP serving as the RPG operational position (RPGOP). The RPGOP is collocated with the RPG and is connected by a dedicated 56-kbps line. The 56-kbps communication link is sufficient to permit the display and viewing of all products at the RPGOP.

The UCP, which is actually part of the RPG, serves as the control device for the system and is used for controlling both RDA and RPG functions.

The WSR-88D data are interfaced with the AFOS system by connecting one of the AFOS System Z high-speed synchronous ports directly to an RPG class III port over a 14.4-kbps dedicated channel. With the deployment of Release 10 of the WSR-88D software, offices are able to upgrade their rates to 14.4-kbps. The Radar Coded Message (RCM) and Hourly Digital Precipitation (HDP) products are transmitted to AFOS through this link (see Figure 2-6).

As AWIPS is deployed, the PUP functionality is displayed through the AWIPS consoles instead of a separate PUP. However, sites to be commissioned will not have all the PUP functionality in the Build 4 time-frame and, therefore, may decide to have the PUP on standby for some period of time. The AWIPS-to-RPG connectivity is provided via the 56-kbps RPGOP port on the RPG. This will provide sufficient bandwidth to permit the AWIPS consoles to display the full suite of NEXRAD products. Sites planning to keep the PUP on standby will connect the 14.4-kbps line to it.

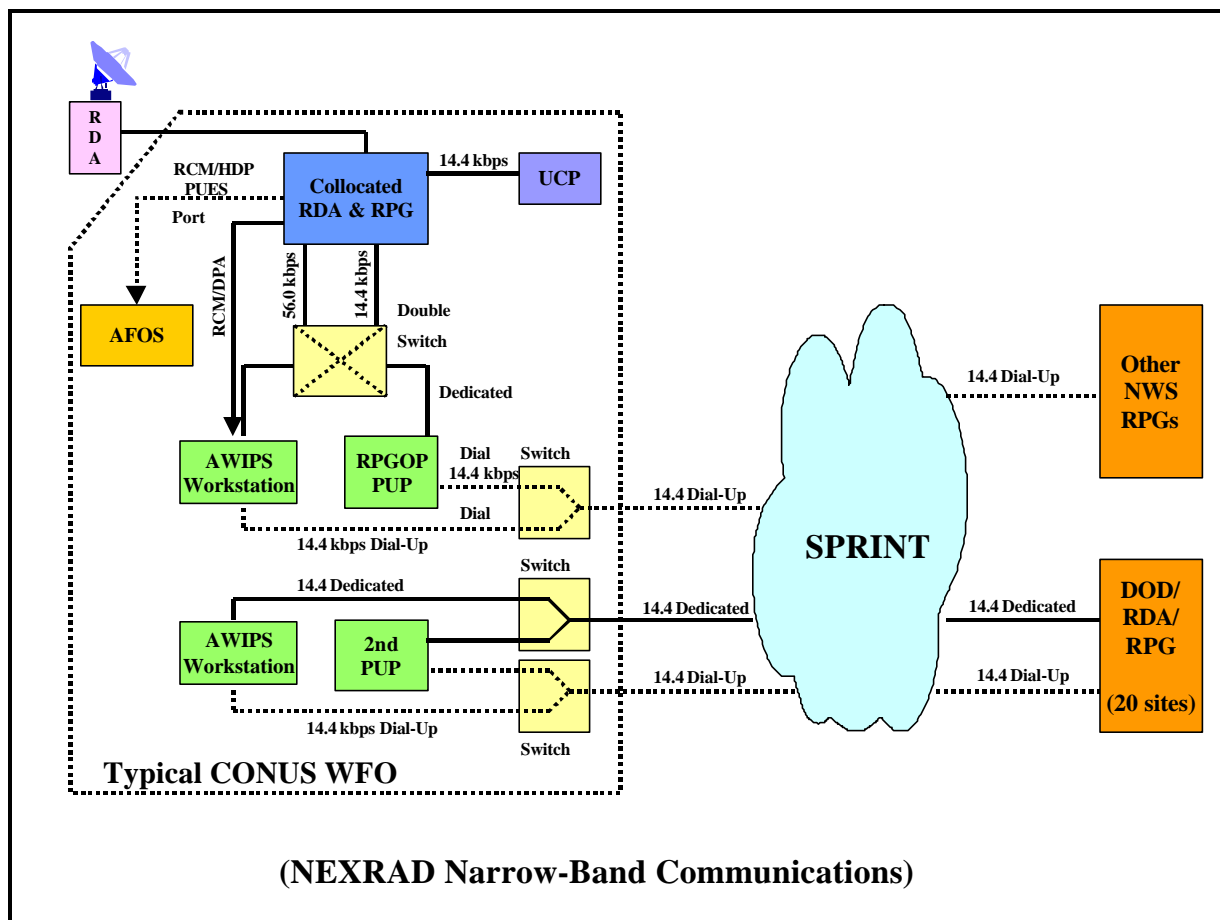


Figure 2-6 Collocated RPG/RDA Sites

The RCM and HDP products designed for AFOS are transitioned over to AWIPS. This means an office acquiring these products will have to revise its radar product suite list to include these products on the 56-kbps line. Furthermore, the HDP product now uses an AWIPS-compatible format referred to as the Digital Precipitation Array (DPA) product. Each office will evaluate the DPA and RCM throughput on the AWIPS network. Figure 2-6 through Figure 2-8 illustrate this transition as part of the commissioning process.

In order to eliminate vendor propriety interfaces, the NWS plans to migrate to an open-system LAN configuration for the RPG as soon as possible. The FAA and DOD have indicated their support for this modification. A redesign of the transmitter subsystem is also planned to improve availability.

At some later date, the NWS hopes to eliminate the RPG LAN and integrate this functionality into the AWIPS LAN configuration. No schedules have been established as yet for this modification.

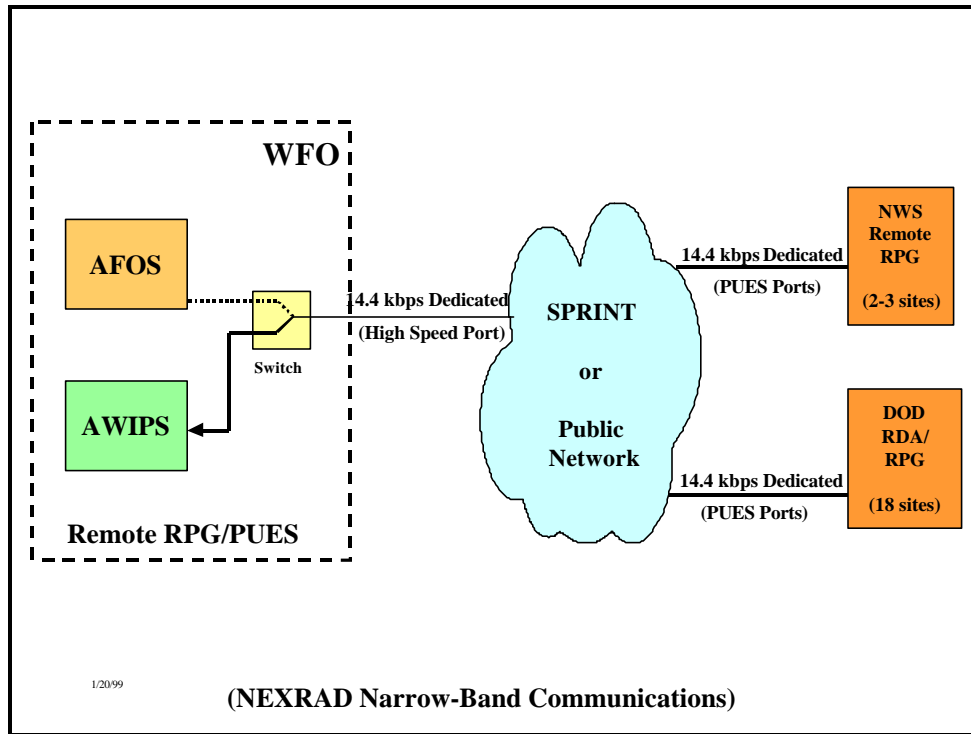


Figure 2-7 DOD Principal User(s) External Systems (PUES) Sites

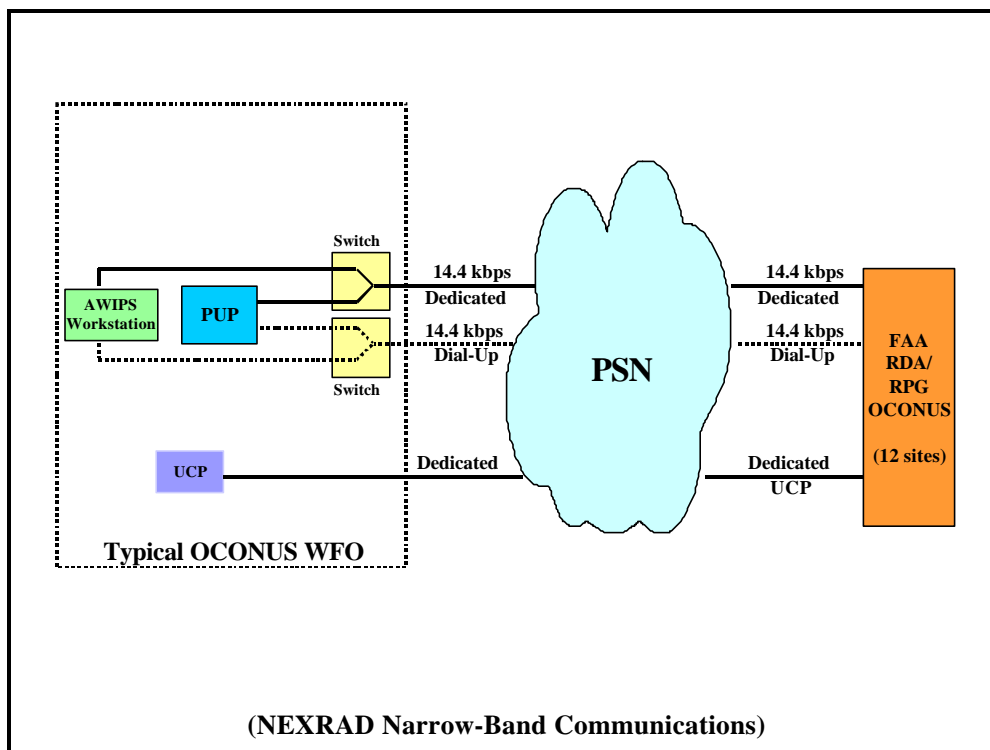


Figure 2-8 OCONUS Sites

2.3.3 NOAA Weather Wire Service

The NWWS is the primary telecommunication network for disseminating NWS forecasts, warnings, and other products to mass news disseminators (newspapers, radio stations, TV stations, etc.) and public safety agencies. The NWWS is responsible for the satellite dissemination of text products to subscribers who pay a monthly fee.

The NWWS system employs satellite transmitting equipment (i.e., uplink) at 57 NWS forecast offices and three National Center locations throughout the CONUS, Alaska, Hawaii, and Puerto Rico. Since not all sites have an NWWS uplink, many sites will need to furnish their suite of NWWS products to a designated NWWS/AWIPS.

Current plans call for an additional NWWS uplink to be placed at the NCF for the transmission of Priority 1 official NWS products issued over the WAN as a second level of backup. This is to replace the NWWS uplink that served this purpose at the AWC. Any warnings, watches, and advisories would be uplinked from this third source for redundancy.

The NWS is planning to upgrade the existing NWWS network with the potential of expanding the number of locations where the uplinks would be interfaced to AWIPS. This will have an impact on the way NWS transitions the NWWS network.

The PIL header would continue to exist only to support the existing NWWS. When the replacement NWWS is fielded, it will rely on the WMO header format for transmission purposes.

Each NWS "uplink" site transmits NWS-generated official NWS products from field offices and other locations (e.g., Tsunami Centers) using the PIL format over a satellite link to the contractor's master facility. These products are checked for duplication, then rebroadcast via satellite to end users who may access this entire stream of NWS products. Equipment needed to receive the NWWS data broadcast must be obtained from the system contractor. In addition to the uplink site, NWS offices transmit their official NWS products to a backup uplink also on the network to ensure redundancy.

Build 4.2 software has the necessary functionality to support all existing or new NWWS required products transmitted from AWIPS, instead of the current legacy system. The connection between NWWS and AWIPS will be evaluated during the commissioning phase to validate that NWWS products are being issued, correctly, over the primary NWWS uplink. The NWWS product feed to its backup site will also be verified. In addition, high priority products will be issued over the third level NWWS backup at the NCF. Figure 2-9 and Figure 2-10 illustrate the transition between AFOS and AWIPS for the existing NWWS network.

If the new NWWS network is implemented by the beginning of CY 00, new transition plans will be incorporated into Appendix C.

The APO in coordination with the SCM will issue notices to each region providing the necessary primary and backup NWWS for each AWIPS location within their domain.

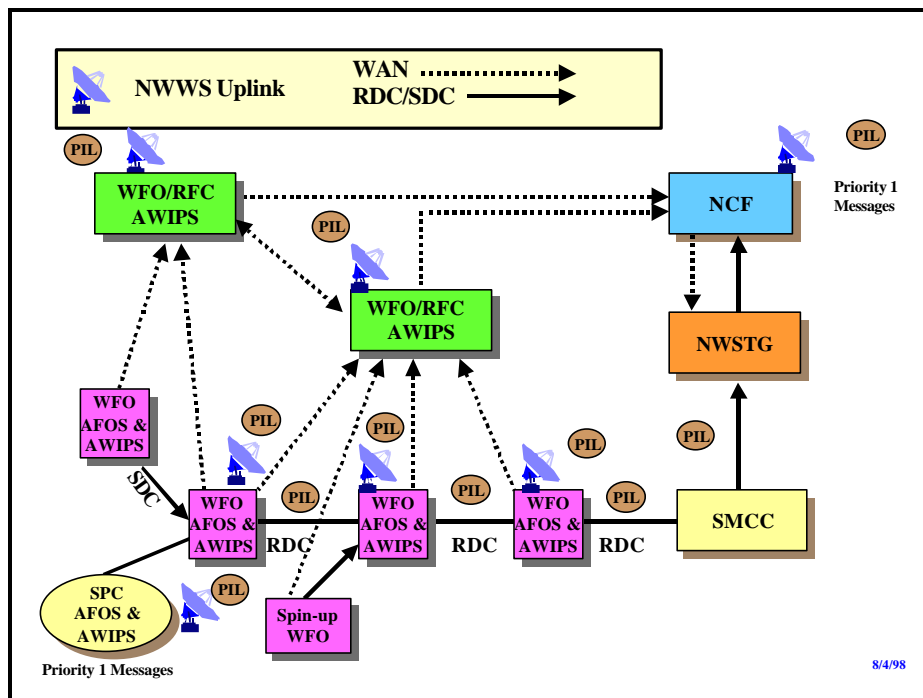


Figure 2-9 Current AFOS/NWWS Configuration.

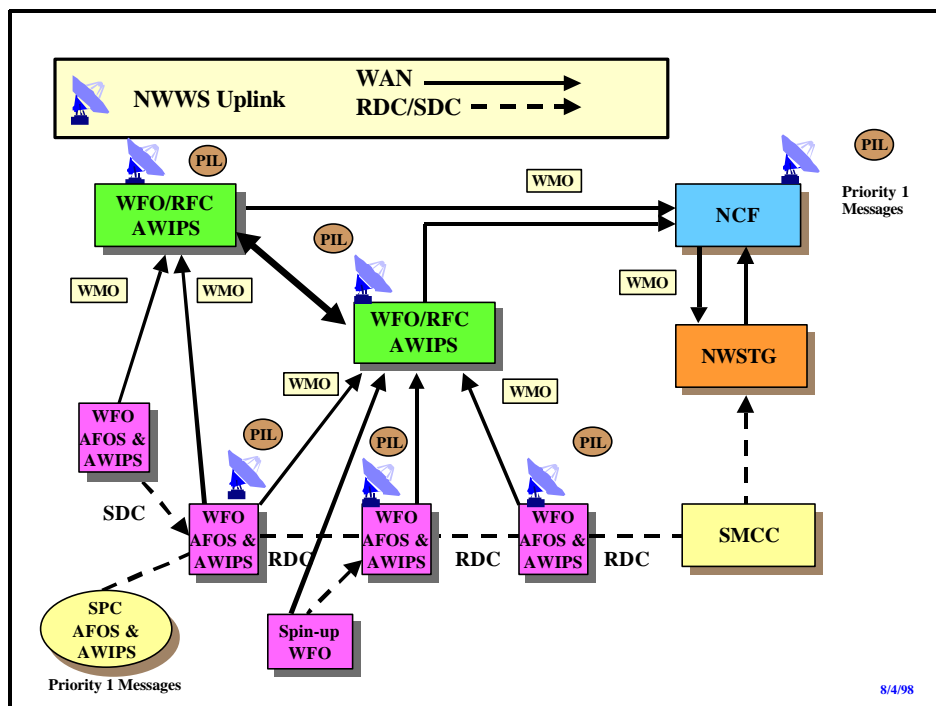


Figure 2-10 Conceptual Product Flow With AWIPS.

2.3.4 ASOS

ASOS performs all basic observing functions: acquisition, processing, distribution, transmission, and documentation of surface data. It is designed to support not only the aviation operations and hydrometeorological forecast activities, but also the general needs of the hydrometeorological, climatological, and meteorological research communities. ASOS provides continuous minute-by-minute observations and performs the basic observing functions necessary to generate Meteorological Aviation Report (METAR), Standard Hydrometeorological Exchange Format (SHEF) precipitation accumulation messages, and Daily and Monthly Summary Messages (DSM/MSM). The deployment of ASOS has more than doubled the number of full-time surface aviation weather observing locations and enabled valuable human resources to devote greater attention to other vital tasks.

The ASOS at each airport location consists of three main components:

- ! Sensor packages, which consist of individual sensors and a Data Collection Package (DCP)
- ! Acquisition Control Unit (ACU)
- ! Peripherals (i.e., ASOS data outlet devices interfaced with the ACU)

The ASOS weather sensors perform the basic function of data acquisition. They continually sample and measure the ambient environment, derive raw sensor data, and make them available to the collocated DCP. These raw sensor data include visibility extinction coefficients, temperature sensor readings, ceilometer cloud hits, etc., and are used by ASOS internally as preliminary input in determining the observed weather elements. The basic set of ASOS sensors consists of the following:

- ! ceilometer (cloud height indicator)
- ! visibility sensor
- ! precipitation identification
- ! freezing rain sensor
- ! pressure sensors
- ! ambient temperature/dew point temperature
- ! anemometer
- ! precipitation accumulation (heated tipping bucket)

Because of the critical importance of the ASOS to NWSFO and NWSO operations, all the ASOSs associated with the office will be interfaced to AWIPS. This connection is initially a dial or dedicated asynchronous connection through the LDAD interface. Figure 2-11 illustrates how data/products are transmitted to the AWIPS and Figure 2-12 shows how the ASOSs under the office's responsibility are linked to AWIPS. The Automated Light Detection and Reporting System (ALDARS) will be an added capability to the ASOS in CY 99.

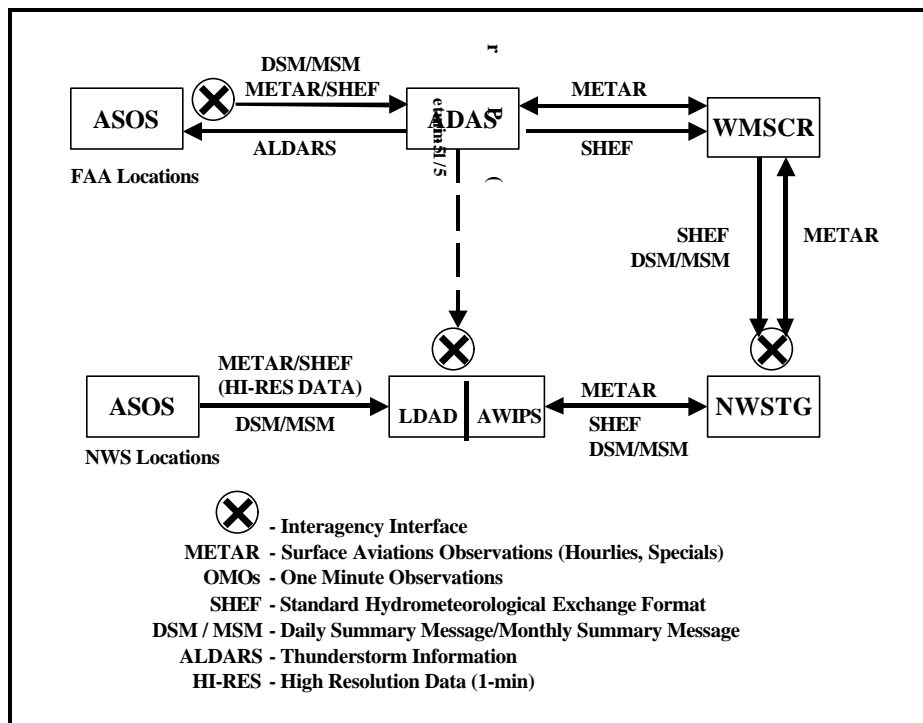


Figure 2-11 ASOS Network Data Flow to AWIPS

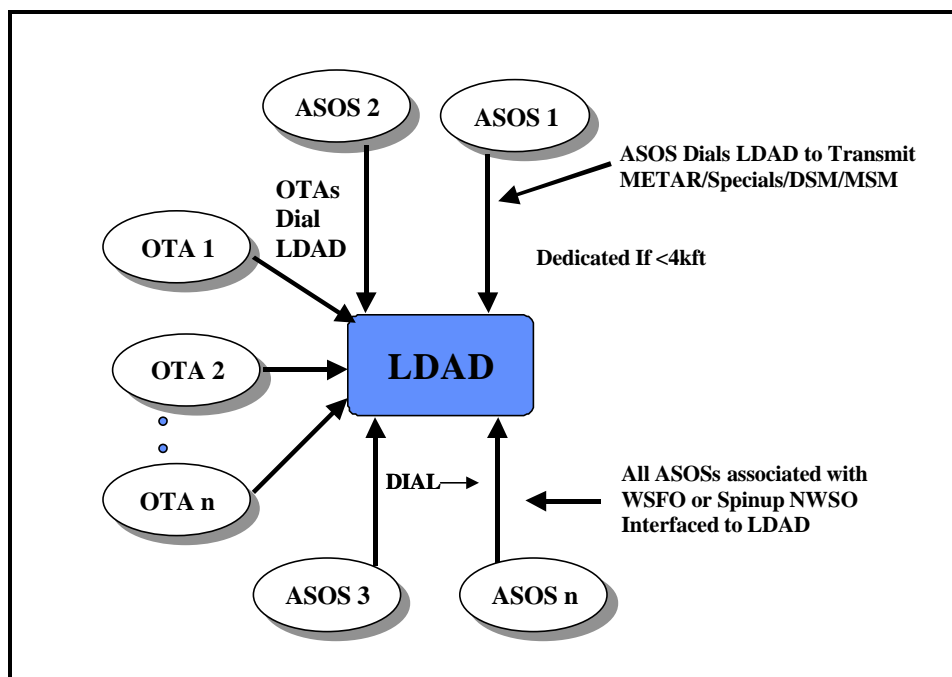


Figure 2-12 Initial ASOS/AWIPS Interfaces

2.3.5 CRS/NOAA Weather Radio Transmitters

The CRS is part of a broadcast system within the NWSFO or NWSO, which supports multiple NOAA Weather Radio (NWR) transmitters. The system takes selective official NWS products and synthesizes them into speech, and voices them over the transmitters to the general public. CRS supports both digitized voice (manually recorded) and synthesized speech (text-to-speech conversion). CRS-compatible product formatters in AWIPS generate text messages into a format suitable for synthesizing by CRS. The initial CRS installations have been interfaced, asynchronously, to AFOS or ARONET (see Figure 2-14). Offices choose the level of automatic processing required for their area of responsibility using locally developed software such as *STORMI/ZIP*, and *Bubble/Air Waves*.

There are three distinct methods for interfacing CRS into AWIPS as follows:

1. AWIPS LAN to CRS LAN Connection - direct connection between systems without the use of intermediate PCs for performing the formatting function.
2. Serial Connection With PC Formatter - an RS-232 interface with a PC in-between AWIPS and CRS for performing the formatting function.
3. Same as 1, With PC Interface - in this case, the PC formatter is interfaced into AWIPS via the asynchronous connection for performing the formatting function. See Figure 2-14.

For options 1 and 3, select product formatters supporting CRS will be available through the selective use of the Interactive Computer-Worded Forecast (ICWF) capability. ICWF allows the office to issue State Area Forecasts, Watches/Warnings/Advisories, Climate messages, and other forecasts. However, not all products sent to CRS, today, will be formatted within the ICWF; therefore, the use of PC formatters may need to be employed to meet the office's needs. The key element is that AWIPS will need to transmit all required products to the CRS without AFOS (see Figure 2-13).

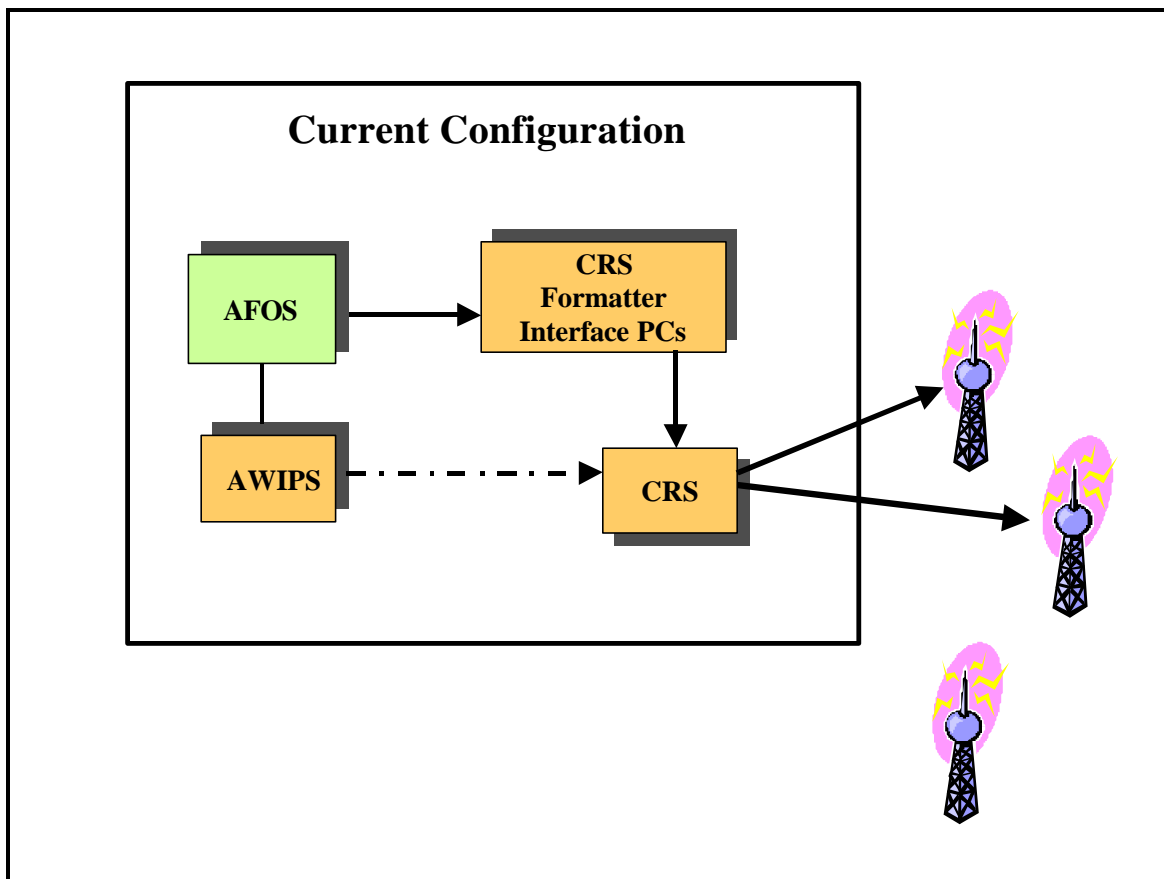


Figure 2-13 AFOS Interface with CRS

2.3.6 Lightning Data

Although not strictly an interface to AWIPS, lightning data are crucial to NWSFO and NWSO operations. Lightning data is available to offices for display on an AWIPS display screen and integrated with other images to form a composite of thunderstorm activity. As a result, receipt and integration of lightning data will be evaluated as part of the commissioning process.

2.3.7 HIPS

The interfacing of HIPS to AWIPS will provide a means to locally acquire non-Geostationary Operational Environmental Satellite (GOES) data sets, allow for added satellite data processing capabilities, and provide a powerful tool by which the forecasters can continue to access a rich set of non-GOES satellite imagery in real time. The HIPS uses an HP 70 series HP-UNIX based system with X-Windows and MOTIF. The LAN configuration is Fiber Distributed Data Interface (FDDI) and Ethernet (10Base2, 10Base5). Some of the HIPS sites have integrated HIPS with their LANs.

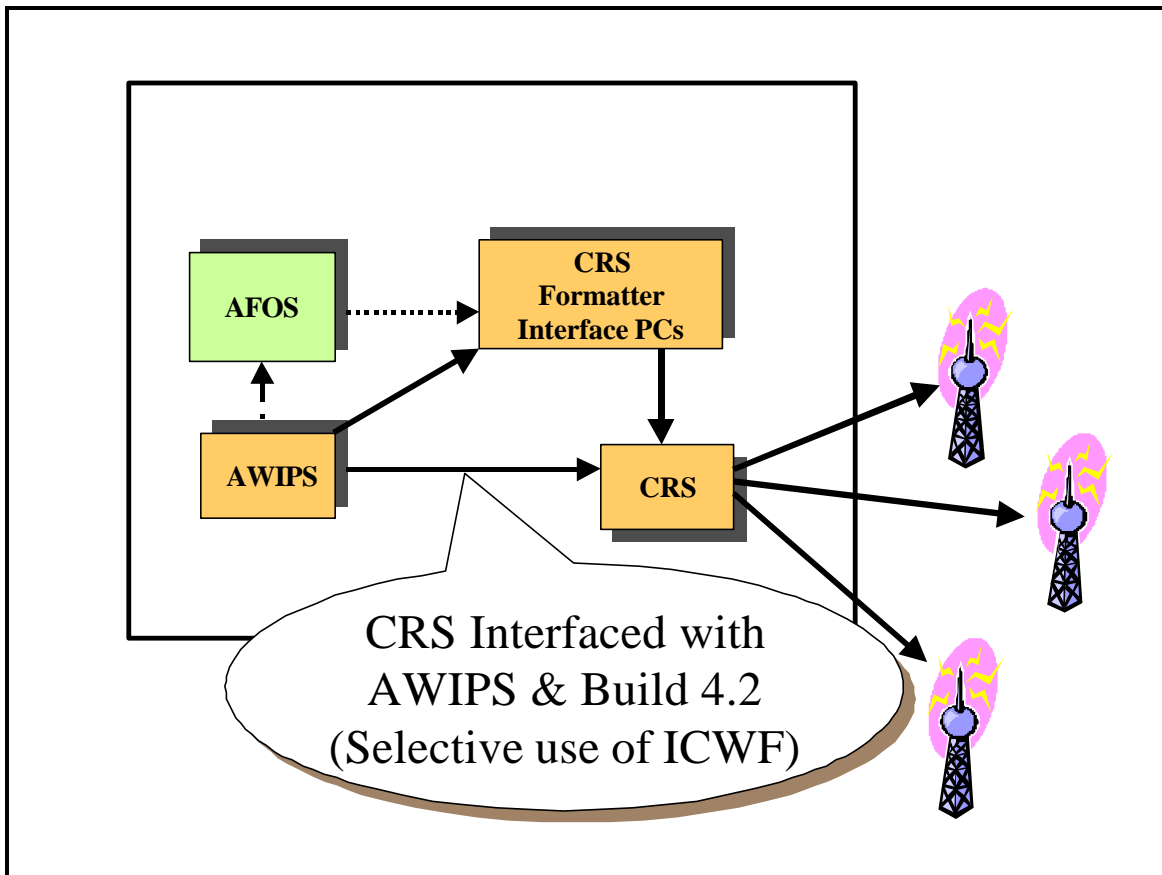


Figure 2-14 Interfacing CRS to AWIPS (Method 3)

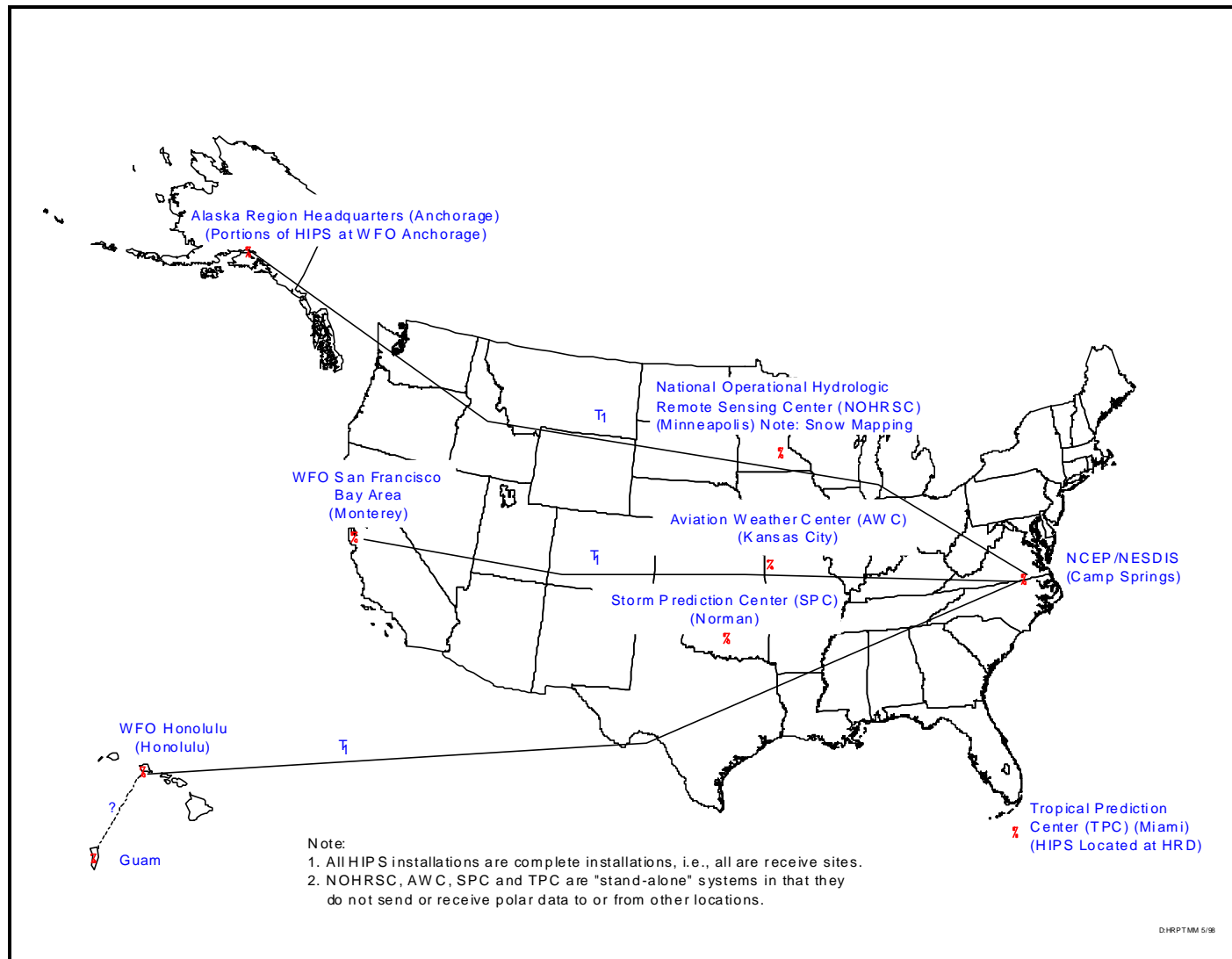


Figure 2-15 HIPS AWIPS Connections

The plan is for AWIPS to provide an interface connection via AWIPS LAN to HIPS LAN. By interfacing the AWIPS to the HIPS via a firewall subnet LAN interface, satellite data sets can be efficiently exchanged while taking advantage of the LAN configurations of both the AWIPS and HIPS. The increased flexibility to the forecaster to utilize the data sets available on HIPS, pass those images to AWIPS, and utilize the tools available on AWIPS to integrate them with radar or gridded model data makes efficient and effective use of both systems. Figure 2-15 illustrates the HIPS locations.

2.4 AWIPS Communication Network

The overall ACN is comprised of two separate and distinct networks—the WAN and the SBN. In addition, the NCF monitors and dispatches contractor-supported maintenance staff to field sites when required (see Figure 2-16).

2.4.1 Network Control Facility

The NCF is responsible for monitoring and controlling the provision of data to the SBN. The AWIPS NCF provides centralized site system and network management for the ACN. Its oversight responsibility is to monitor all aspects of the AWIPS operation and address problems as they are identified. The NCF architecture (see Figure 2-17) provides monitoring and control, system support, communications, and data management functionality. These capabilities support real-time AWIPS site operations. The NCF is located within the NWSTG in Building 2 of the Silver Spring Metro Center (SSMC) complex in Silver Spring, MD. The NCF collects meteorological data and distributes them to AWIPS sites via the SBN. The NCF is responsible for network management, site monitoring, field site support, maintenance dispatch and monitoring, network system administration, and field software distribution.

Specific objectives are to:

- ! Provide the point-to-multipoint network to deliver NOAAPORT data to AWIPS sites. The NCF transmits both the NCEP model output and National Environmental Satellite, Data, and Information Service (NESDIS) imagery (currently from GOES 8 and GOES 9) on the SBN. The NCF utilizes the point-to-point terrestrial network for network monitoring and control. The multipoint-to-point network is used to broadcast field-generated (terrestrial) data to other AWIPS sites via the NCF.
- ! Provide real-time, 24-hour monitoring of the AWIPS network and site operational status to enable continuous, error-free delivery of data products. NCF personnel respond to: problems reported by AWIPS field sites or detected automatically by the NCF, inquiries regarding site operations status, and questions regarding product integrity. NCF personnel initiate corrective actions, as appropriate.

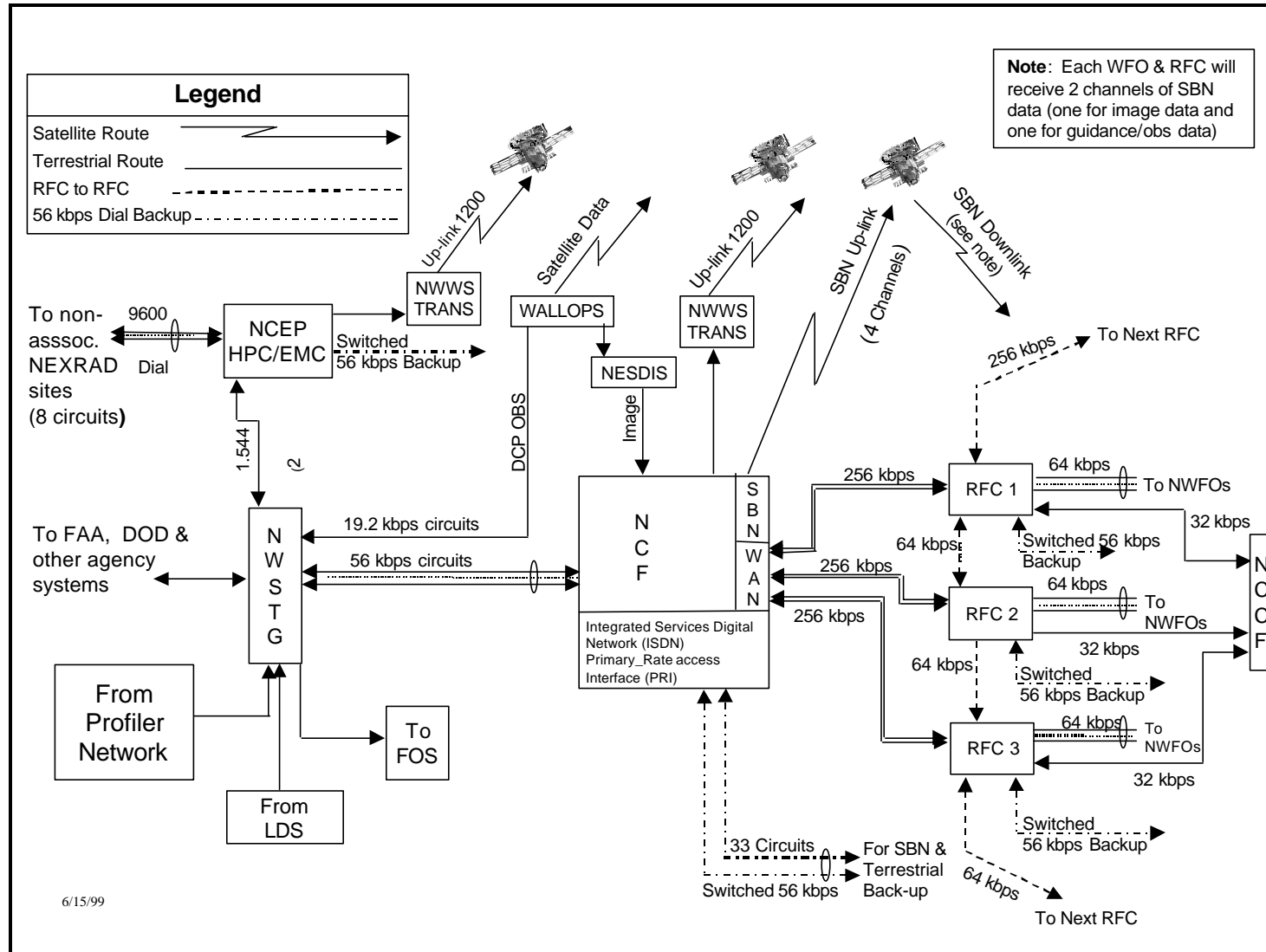


Figure 2-16 AWIPS Communications (Backbone Network)

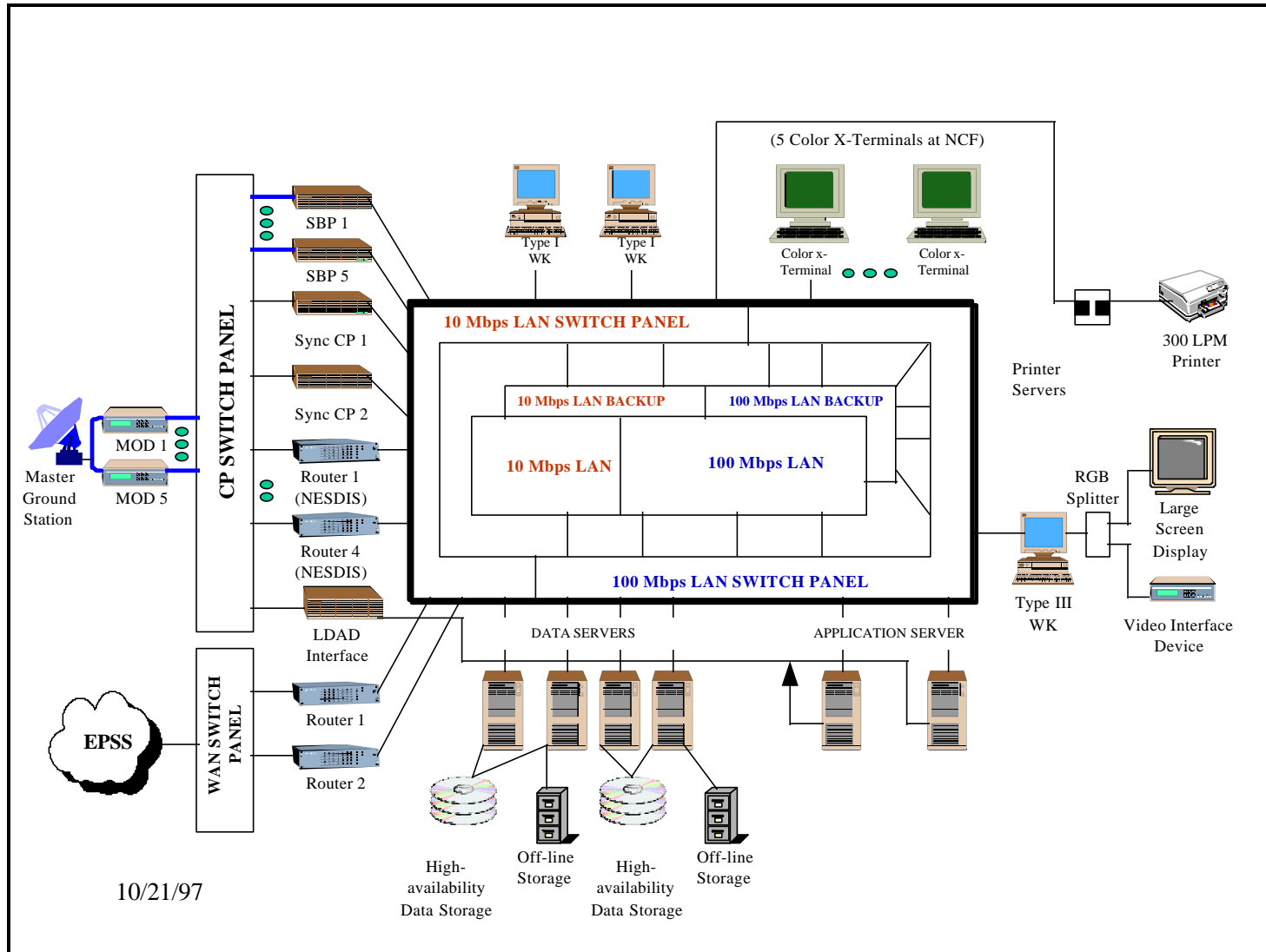


Figure 2-17 AWIPS NCF Architecture

- ! Manage AWIPS maintenance by performing first echelon maintenance or through third party maintenance agreements, escalation procedures, and dispatch. The NCF ensures that specified system availability requirements are met by responding quickly to system malfunctions when notified. The NCF takes appropriate corrective actions to restore lost site functionality and minimize degradation to operational services.
- ! Provide network system administration for all AWIPS sites to ensure that critical operations are maintained and available when needed. Provide site system backup files, maintain archived data, routinely exercise backup procedures and systems, gather and process overall system performance data, and administer the AWIPS network security features.

The NCF has the ability to remotely reconfigure, restart, and restore a site to core level of operational capability, administer system changes or modifications to all sites, facilitate software distribution, and assist in installation of all AWIPS maintaining an approved software baseline.

2.4.2 WAN

The AWIPS WAN, along with 56-kbps dial backup circuits, is designed to meet a 99.99% network availability requirement per AWIPS specifications. The WAN has the following key features:

1. Frame-relay, dual-homed, permanent virtual circuits (virtual paths) are installed between the collocated offices, and NWSFO/NWSO, and between the collocated offices and the NCF.
2. Collocated offices and the NCF are the hubs on the backbone of the network and have two T-1 access circuits and two frame-relay Digital Service Unit/Channel Service Units (DSU/CSU).
3. Each NWSFO and NWSO, NC, and regional headquarters location has one 56-kbps dial backup line (which is the backup circuit), and each collocated office has four 56-kbps dial backup lines.

Almost every AWIPS node has a potential terrestrial telecommunication single point-of-failure. This potential failure point exists since there is only one easement and one local access feeder cable between an AWIPS site and the first cable crossroad that connects the site telecommunications to the local telephone company. For a graphical depiction of these networks, refer to Appendix A.

Terrestrial Network - The terrestrial WAN utilizes digital frame-relay circuits to provide a high-speed network connecting all NWS field sites to the NCF. The backbone of this network (see Figure 2-18) consists of two 256-kbps diversely-routed circuits between the NCF and each of the 13 combined NWSFO and NWSO/RFC field sites. In turn, the collocated sites act as “hubs” to provide connectivity to all NWSFO and NWSO sites in their geographic area of responsibility. Each NWSFO and NWSO is connected to its hub over a 128-kbps circuit and a second 128-kbps circuit to an alternate hub for “backup” purposes. In addition, each field site is equipped with a switched 56-kbps circuit that can serve as a dial backup capability. The NCF is equipped with 33 of these ports to provide dial-in access for the field sites.

Field-generated products are transmitted over the terrestrial network to the NCF where they are forwarded to the SBN for distribution to other NWS sites via the NOAAPORT data stream or to

the NWSTG for transmission to other agencies and world organizations. The WAN is also used to handle any special request/reply activity between the NCF and the field sites.

The architectures for the Alaska and Pacific Regions (see Figure 2-19) are similar to the conterminous regions. NWSFOs in these regions are connected to the Portland, OR, and Sacramento, CA, collocated offices over dedicated terrestrial facilities. Each NWSFO and NWSO has an SBN downlink. San Juan, PR is also configured in a similar way, connecting to the Atlanta, GA and New Orleans, LA collocated facilities.

2.4.3 Satellite Broadcast Network

The SBN distributes satellite imagery and centrally produced data/products to AWIPS field offices via a satellite broadcast. The Government contractor, PRC, is responsible for the operation and maintenance of the system. The Government contracts to PRC, who is wholly responsible for the SBN. PRC subcontracts to GTE, who does the actual work, but the Government never coordinates directly with GTE. The SBN is designed by the AWIPS prime contractor to meet a 99.5% availability per AWIPS specifications. Each AWIPS node has a downlink receive-only antenna utilizing C-band frequencies. The satellite master ground station (MGS) is located in Ft. Meade, MD.

The SBN provides a point-to-multipoint broadcast capability for distribution of weather-related data and products to NWS field sites, special centers, and other users of weather data (see Figure 2-20). The transmitted SBN signal is known as the NOAAPORT data stream and consists of a fixed suite of products transmitted on a regularly scheduled basis. Each field site and NC is equipped with a NOAAPORT transmitting satellite products, official NWS products, NCEP model, and the 1-minute lightning data feeds. A modified version of the downlink, known as the NOAAPORT Receive System (NRS), is available for use by other agencies and users to receive the NOAAPORT signal and interface it to their external systems.

The NOAAPORT/SBN is a NOAA public service transmission of weather data from the NWS and NESDIS. NOAA established the distribution system to meet the NWS requirement for distribution of centrally produced data to its offices, and public and private operational and research users of its data. The system, therefore, serves a dual purpose in that it distributes data within the NWS and also serves as a dissemination tool for outside users (see Figure 2-20).

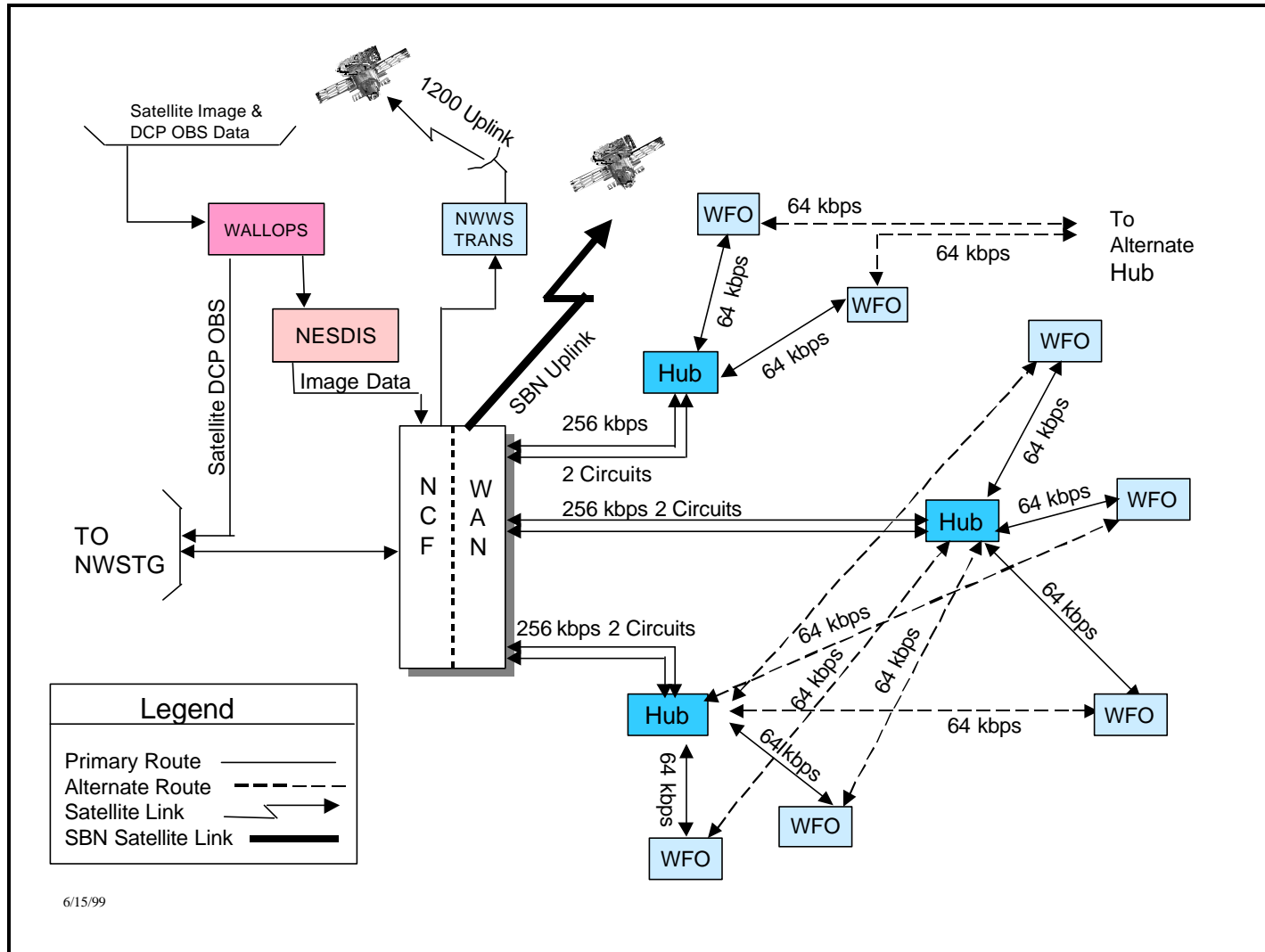


Figure 2-18 AWIPS Communications (NWSFO and NWSO/RFC/NC Links)

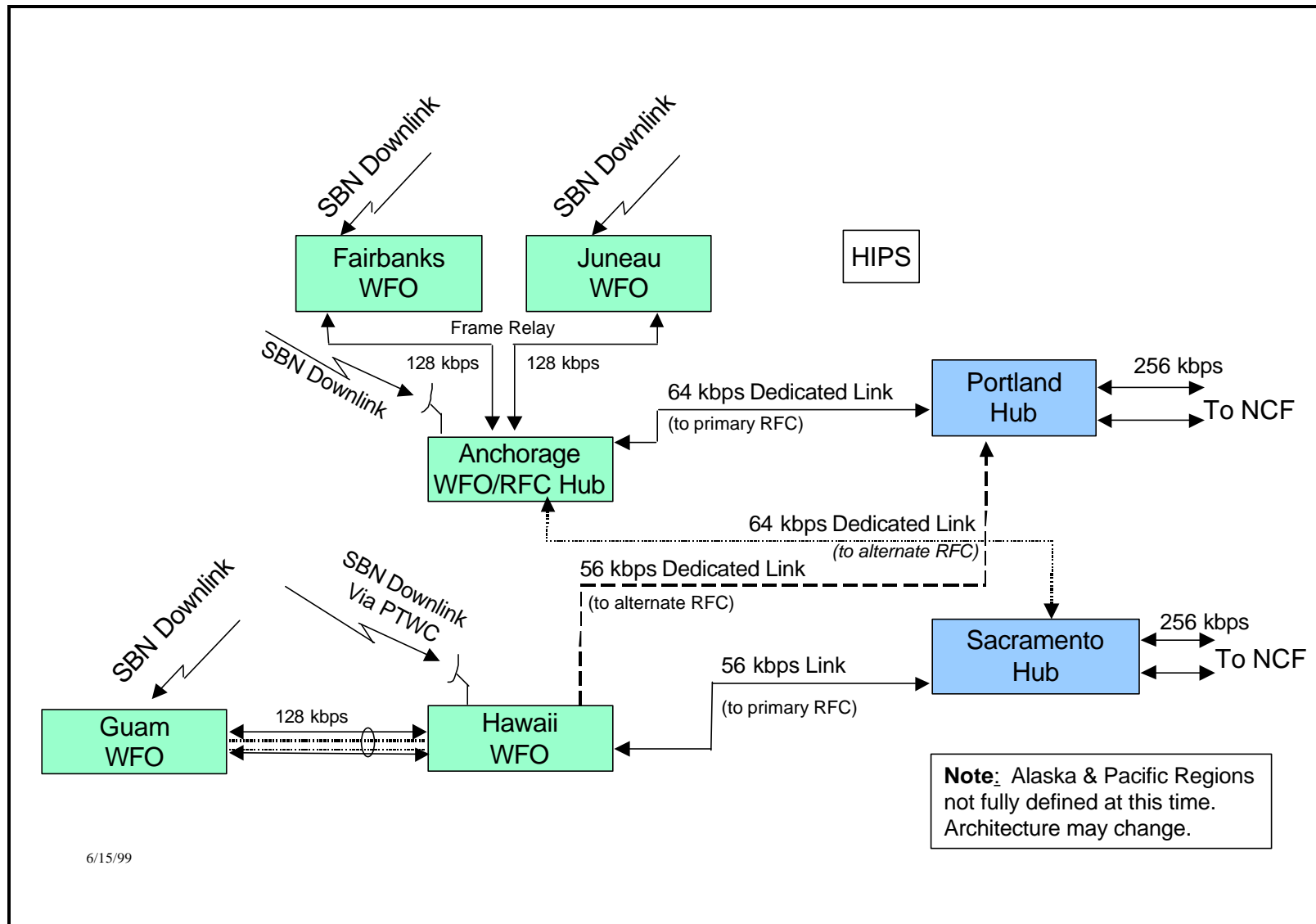


Figure 2-19 Alaska and Pacific Future Architecture

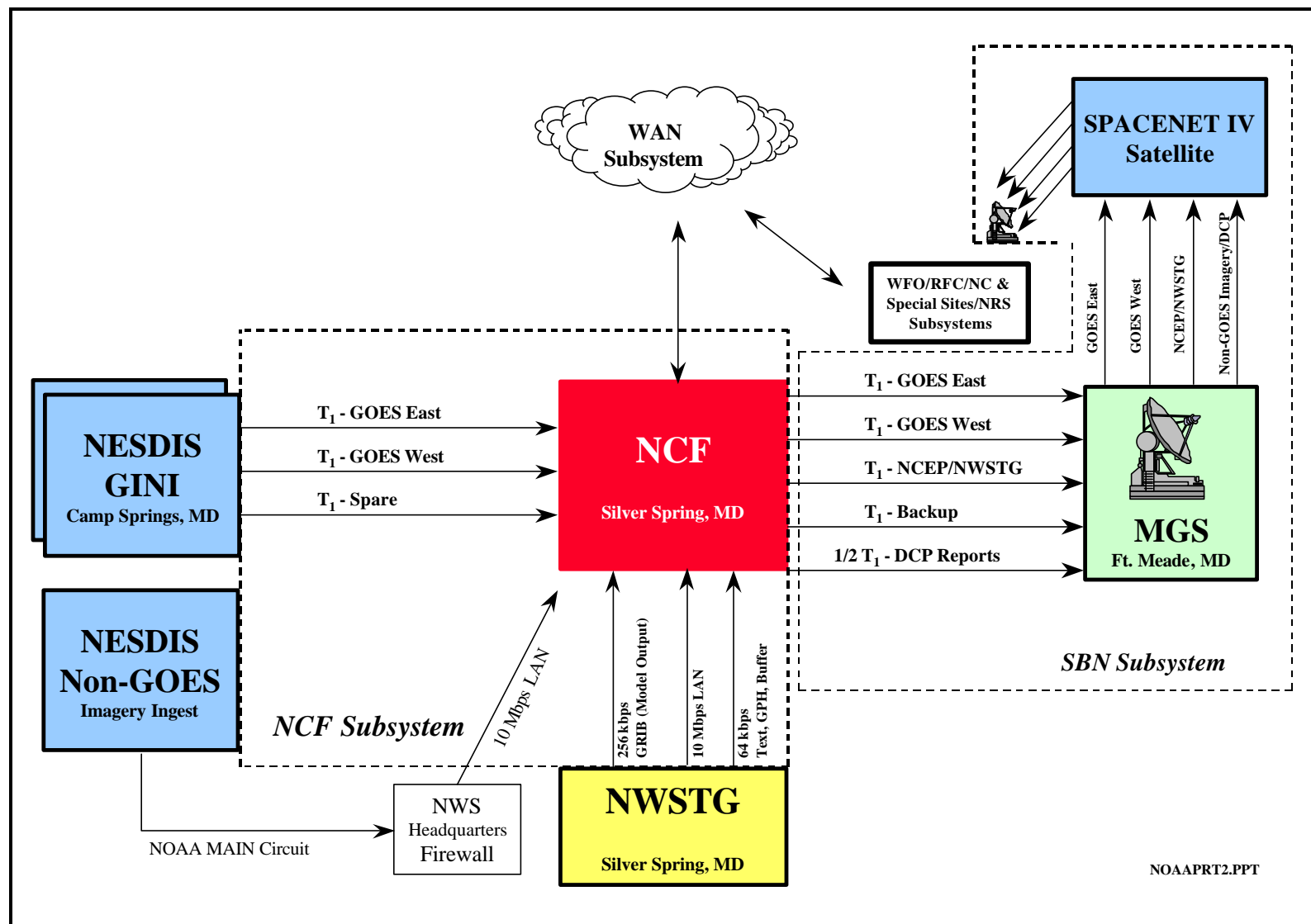


Figure 2-20 Data Feed to NOAAPORT